Assessing CFS Version 2 Forecasts for Heavy Precipitation Using CPC Gauge – Satellite Merged Analysis

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Background

- Over the past 10 years or so, a suite of observational precipitation products have been developed at NOAA Climate Prediction Center (CPC) with continued supports from CPO, HMT, and couple other programs
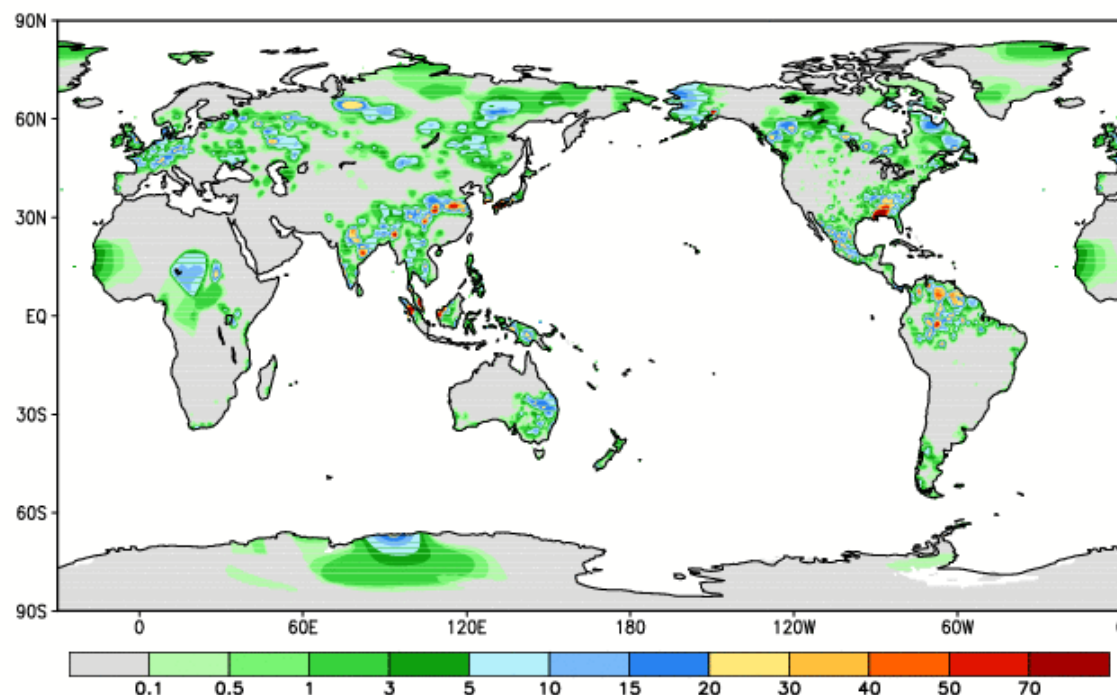
CPC Unified Precipitation Products [1] *Components*

- Unified and quality controlled station data archives
    - *Integrate data sets from various sources*
    - *Quality control*
    - *Monthly, Daily, Hourly*
    - *Global, US*

- Integrated satellite precipitation estimates
    - *CMORPH*
    - *Integrate satellite precip information from all available platforms*
    - *Global, high-resolution, real-time,*

- Gauge-based, gauge-satellite merged analyses
    - *Global, regional*
    - *Monthly, daily, hourly*
    - *Historical records, RT updates*

CPC Unified Precipitation Products [2]
## *Global Daily Gauge Analysis*

- Interpolation of gauge reports from ~30K stations

- Optimal Interpolation (OI) with orographic correction (Xie et al. 2007)

- Interpolated on 0.125^olat/lon, then averaged on 0.5^olat/lon grid over global land for release

- Global fields from1979 to present updated daily on a real-time basis

- CONUS analysis from 1948 on 0.25^olat/lon

- Example for July 1, 200

- Operational

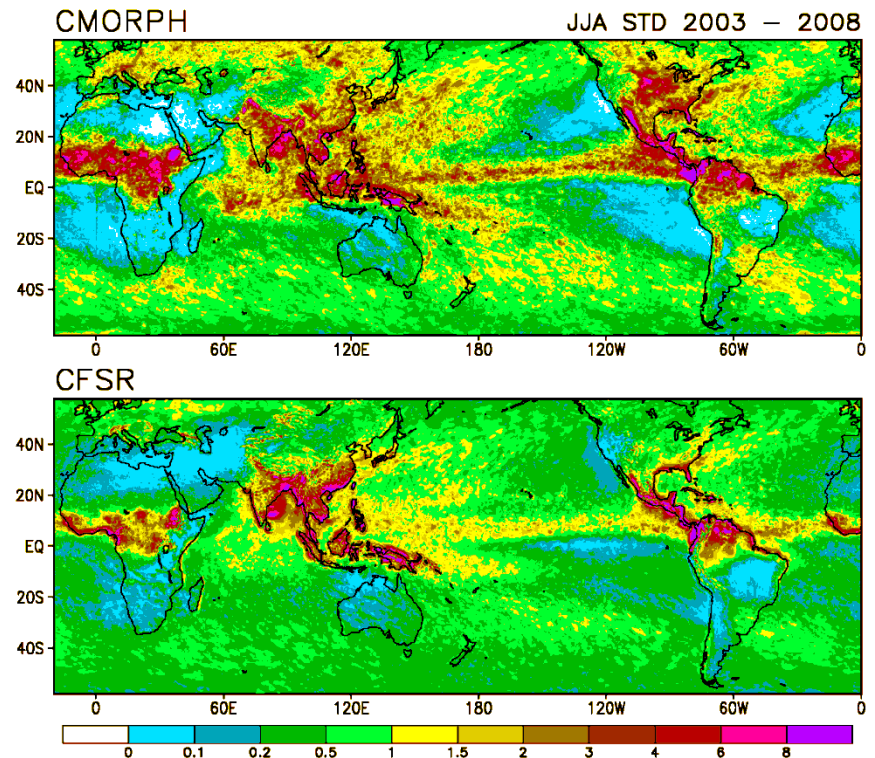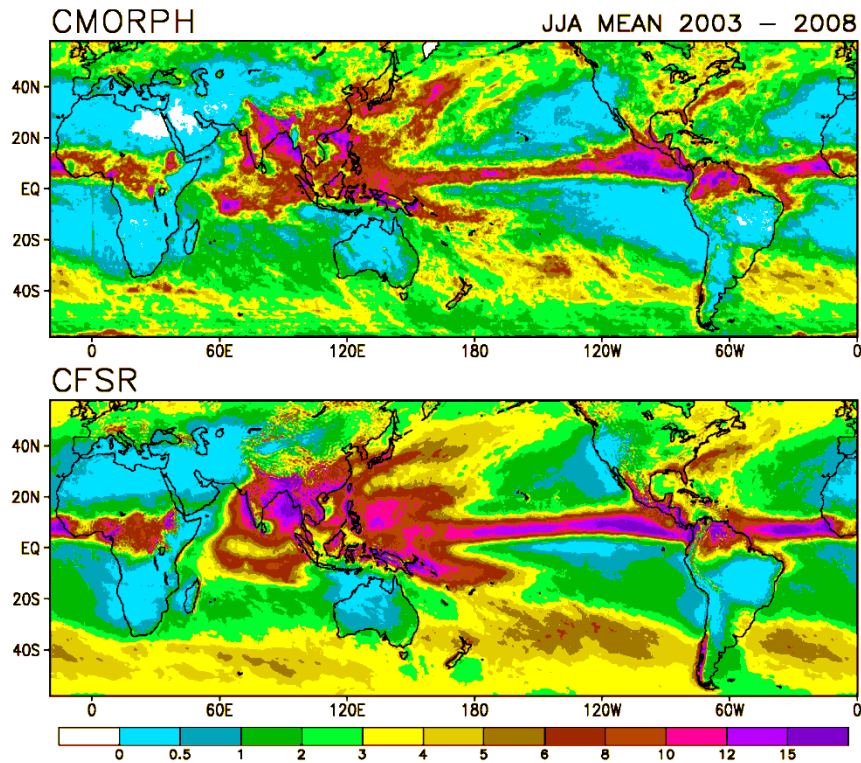# CPC Unified Precipitation Products [3]
CMORPH Satellite Estimates

- 8kmx8km / 60°S-60°N;

- 30-min interval / from January1998 / Real Time

HURRICANE MITCH (mm/hr)
00:00 UTC 26 October 1998
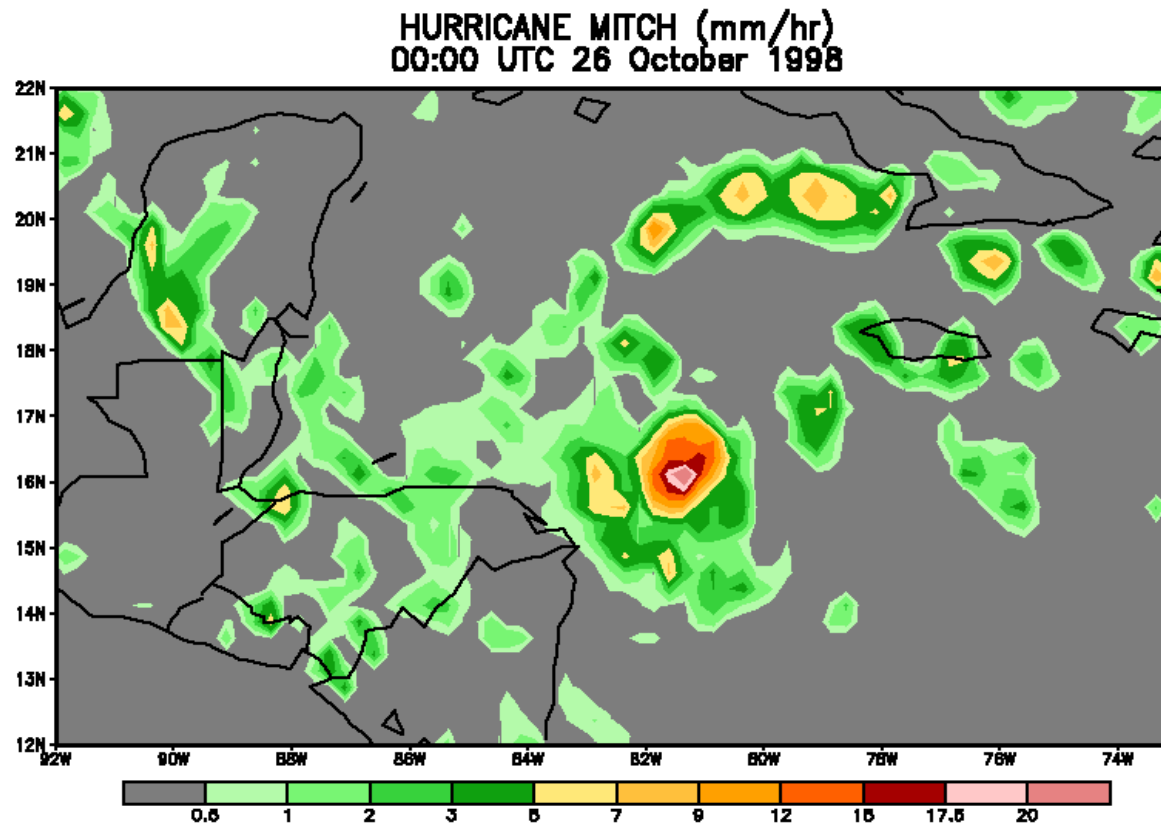
CPC Unified Precipitation Products [4]
XMORPH with Bias Corrected

Our Next Steps

- **Take advantage of the global precipitation products for the improvements of climate operations**

  - **Climate Monitoring**
  - **Climate Model Verifications**
  - **Improving and assessing climate forecasts**

# Correcting the bias in the CFS Version 2 Precipitation forecasts

Methodology

- Removing the bias the CFS daily precipitation forecasts through matching the CPDF of forecasts with that of the gauge-based analysis of daily precipitation

- CPDF tables are established for each grid point, for each calendar day, and for each leading time

CPDF for Daily Precipitation at [92.563W;40.157N]

January

- Top:
  CFSRR of 0-Day Lead

- Bottom:
  CFSRR of 1-Day Lead

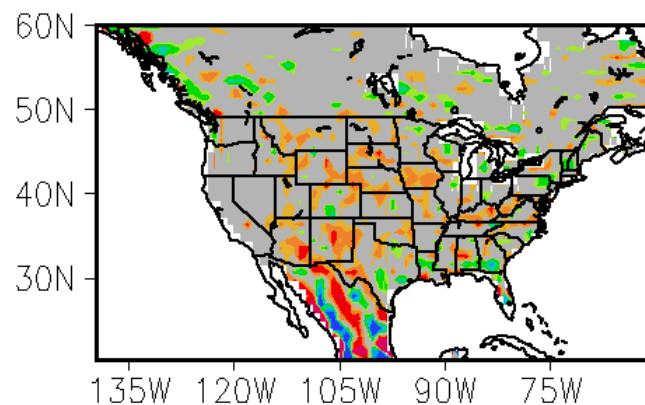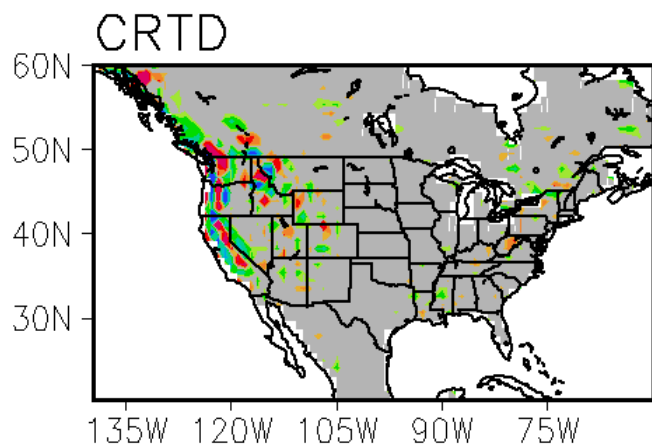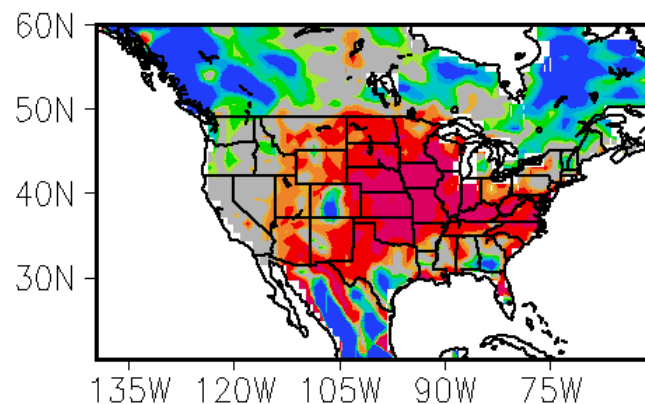- PDF of bias-corrected CFSV2 precipitation is very close to that of the gauge observations
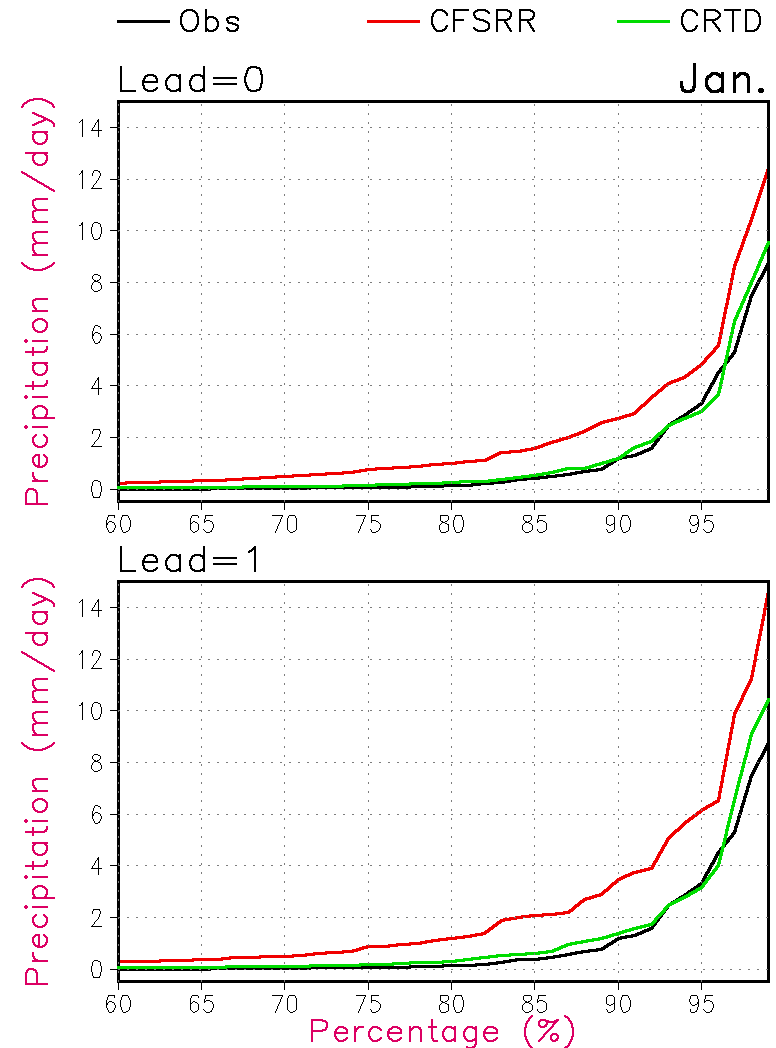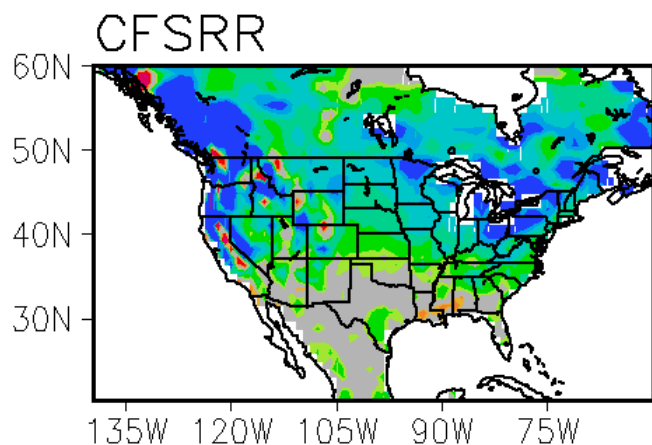
Performance of CFSv2 Monthly Precipitation
*Bias (mm/day) for DJF (left) and JJA (right) from 1999 - 2010*

Performance of CFSv2 Monthly Precipitation
## CFSv2 Statistics for CONUS precipitation

- Spin up in CFSRR over the first 5 days or so

- Anomaly correlation falls to close to zero after 15-20 days

- PDF matching is capable of substantially removing the bias in the CFSRR

- The corrected CFSRR presents slightly higher pattern correlation that that for the original forecasts

- Slight negative bias in the corrected CFSRR caused by inability of the method to adjust forecasts of 0-rainfall
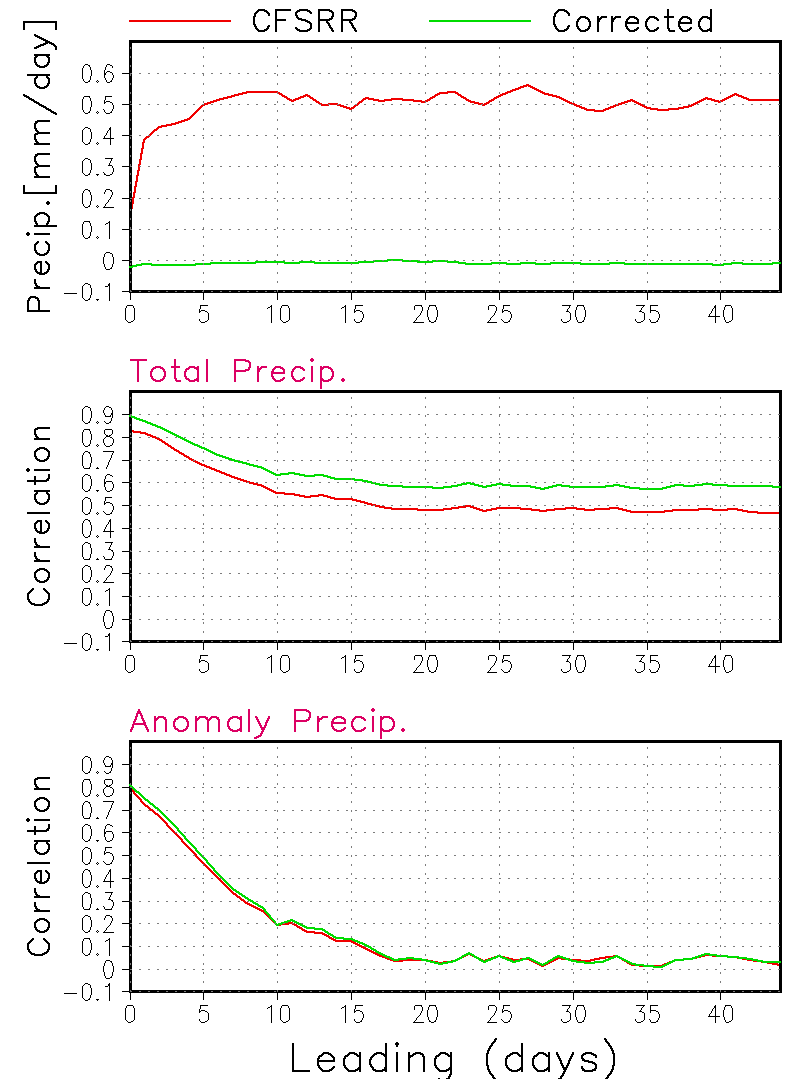
Performance of CFSv2 To Detect Heavy Rainfall
Heidke Skill Score as a function of season and leading time

- Performance of CFSv2 to detect the occurrence of daily precipitation exceeding 90th percentile

- Definition of a heavy rainfall event for a pentad period:
  - *Daily rainfall for one or more days in the target pentad period exceeding 90th percentile*

- Definition of a hit for the forecast:
  - *Daily rainfall forecasts (after bias correction) for one or more days in the target pentad period exceeding 90th percentile*
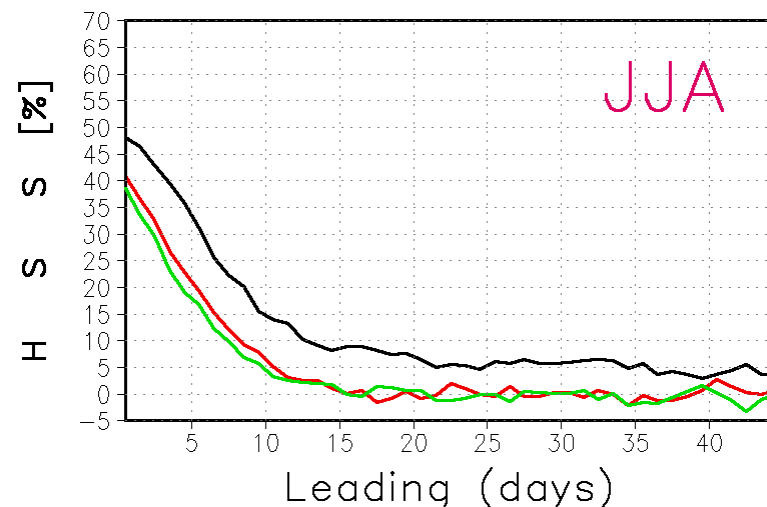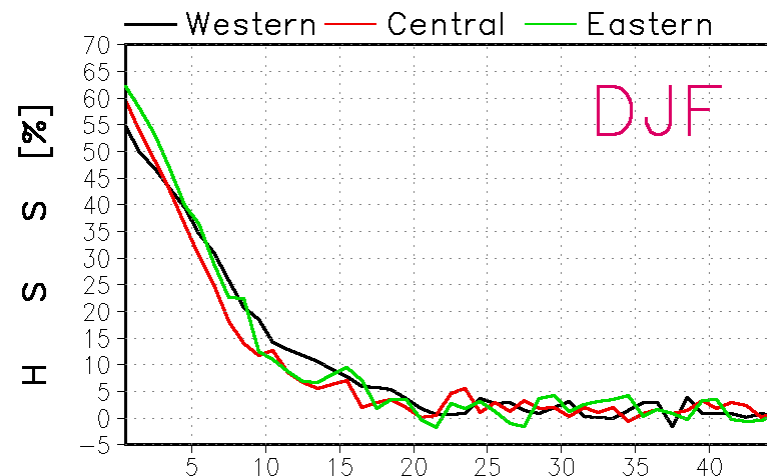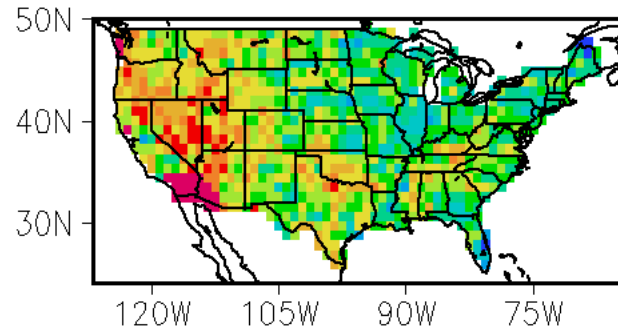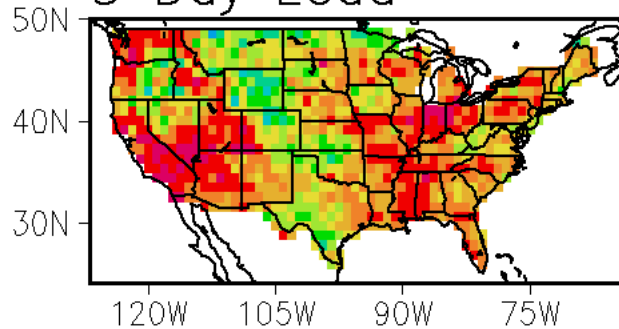
Performance of CFSv2 To Detect Heavy Rainfall
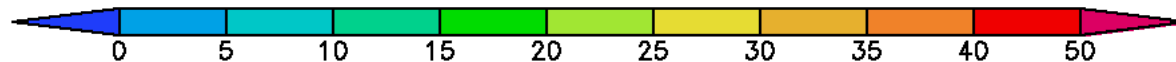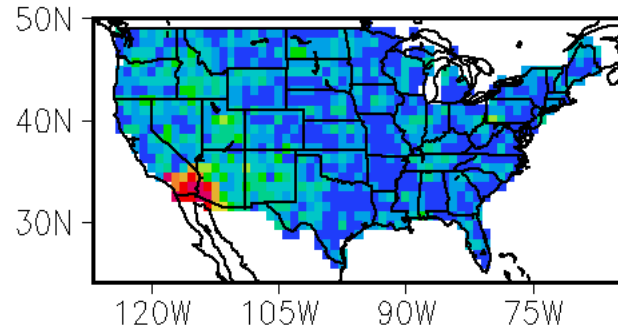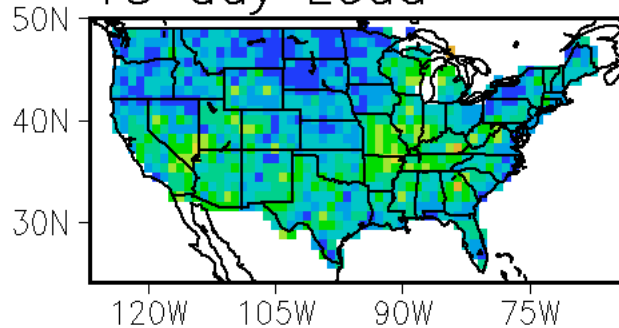## *Heidke Skill Score as a function of season and region*

Summary

- Preliminary investigation demonstrated the effectiveness and feasibility of the PDF matching method to correct the bias in the CFSv2 precipitation fields

- Corrected CFSv2 presents overall magnitude and PDF of precipitation intensity in very close agreements with those of the gauge observations

- CFSv2 exhibit some skills in predicting the mean precipitation anomaly and the occurrence of heavy rainfall in the first 15 days or so. The skills, however, diminish for forecasts with leading time of 15 days or longer.

- Work is under way to repeat the work for CFSv2 forecasts over the entire global land area.